APPENDIX

stitution of a compound or element. A compound is homogeneous since it is composed of one and only one group of atoms represented by a formula. For example, pure water is homogeneous because it contains no other substance than is indicated by its formula, H_2O. Homogeneity is a characteristic property of compounds and elements (collectively called substances) as opposed to mixtures. The term is often loosely used to describe a mixture or solution composed of two or more compounds or elements that are uniformly dispersed in each other. Actually, no solution or mixture can be homogeneous; the situation is more accurately described by the phrase "uniformly dispersed." Thus so-called homogenized milk is not truly homogeneous; it is a mixture in which the fat particles have been mechanically reduced to a size that permits uniform dispersion and consequent stability.
See mixture; compound; heterogeneous; substance.

homogeneous catalysis. See catalysis, homogeneous.

homogeneous reaction. A chemical reaction in which the reacting substances are in the same phase of matter, i.e., solid, liquid, or gaseous.
See catalysis, homogeneous.

homogenization. A mechanical process for reducing the size of the fat particles of an emulsion (usually milk) to uniform size, thus creating a colloidal system that is unaffected by gravity. The original diameter of the fat particles (6–10 microns) is reduced to 1–2 microns, with an increase in total surface area of 4–6 times. This is done by passing the milk through a homogenizer (or colloid mill), a machine having small channels, under a pressure of 2000–2500 psi at a speed of approximately 700 ft/sec. This operation not only brings about a permanently stable system, but also changes the properties of the milk in respect to taste, color, and the chemical nature of the protective coating on the fat particles. It also increases its sensitivity to light and its tendency to foam. The forces involved are shear, impingement, distention, and cavitation.
See homogeneous; colloid mill.

homologous series. A series of organic compounds in which each successive member has one more CH_2 group in its molecule than the preceding member. For instance CH_3OH (methanol), C_2H_5OH (ethanol), C_3H_7OH (propanol), etc., form a homologous series.

homomenthyl salicylate. (3,3,5-trimethylcyclohexyl salicylate). $(CH_3)_3C_6H_8OOCC_6H_4OH$. A homolog of menthyl salicylate.
Properties: Light-yellow oil; odorless. Neutral and nonirritating to the skin. Absorbs UV radiation in sunlight (2940–3200 Å). Insoluble in water; soluble in alcohol, chloroform, and ether.
Use: UV filter for antisunburn creams.

homomorphs. Molecules similar in size and shape. They need have no other characteristics in common. Many properties of several homomorphs can be predicted by knowing properties of one.

homophthalic acid. $C_6H_4(CH_2COOH)COOH$.
Properties: Light-tan powder.
Use: Intermediate.

homopolar adsorption. See apolar adsorption.

homopolymer. A natural or synthetic high polymer derived from a single monomer. An example of a natural homopolymer is rubber hydrocarbon, whose monomer is isoprene; a synthetic homopolymer is typified by polychloroprene or polystyrene, whose monomers are, respectively, chloroprene and styrene.
See polyblend.

homosalate. $C_{16}H_{22}O_3$.
Properties: Liquid. Bp 162C (4 mm Hg), d 1.05, refr index 1.51.
Use: Sunscreening agent.

***o*-homosalicylic acid.** See cresotic acid.

homoveratric acid. (3,4-dimethoxyphenylacetic acid). $(CH_3O)_2C_6H_3CH_2COOH$.
Properties: Crystals. Mp 94–101C. Very slightly soluble in water; soluble in most organic solvents.

homoveratrylamine. (3,4-dimethoxyphenylethylamine). $(CH_3O)_2C_6H_3(CH_2)_2NH_2$.
Properties: Colorless to pale-yellow liquid; slight vanilla odor. D 1.09 (25/25C), solidifies 15C, bp 295C (decomposes), refr index 1.5442–1.5452 (25C).

honey. A unique mixture of a number of low-molecular-weight sugars (except sucrose) but including invert sugar. It is considerably sweeter than glucose.
Use: A food and sweetener since the beginning of civilization; also has applications in medicine and tobacco processing.

Hooker reaction. Oxidation of 2-hydroxy-3-alkyl-1,4-quinones with dilute alkaline permanganate with shortening of the alkyl side chain by a methylene group and simultaneous exchange of hydroxyl and alkyl or alkenyl group positions.

Hooke's law. When a load is applied to any elastic body so that the body is deformed or strained, then the resulting stress (the tendency of the body to resume its normal condition) is proportional to the strain. Stress is measured in units of force per unit area; strain is the extent of the deformation. For example, when a bar of metal is subjected to a stretching load, the extent of the increase in length

Hawley's

Condensed Chemical

Dictionary

THIRTEENTH EDITION

Revised by

Richard J. Lewis, Sr.

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trial fixation of atmospheric nitrogen (the process was further developed by Bosch). Nobel Prize, 1918.

Rutherford, Sir Ernest (1871–1937). First to prove radioactive decay of heavy elements and to carry out a transmutation reaction (1919). Discovered half-life of radioactive elements. Nobel Prize, 1908.

Lewis, Gilbert N. (1875–1946). Proposed electron-pair theory of acids and bases; authority on thermodynamics.

Aston, F. W. (1877–1945). Pioneer work on isotopes and their separation by mass spectrograph. Nobel Prize, 1922.

Fischer, Hans (1881–1945). Basic research on porphyrins, chlorophyll, carotene; synthesized hemin. Nobel Prize, 1930.

Langmuir, Irving (1881–1957). Fundamental research on surface chemistry, monomolecular films, emulsion chemistry. Also electric discharges in gases, cloud seeding, etc. Nobel Prize, 1932.

Staudinger, Hermann (1881–1965). Fundamental research on high-polymer structure, catalytic synthesis, polymerization mechanisms, resulting eventually in development of stereospecific catalysts by Ziegler and Natta (stereoregular polymers). Nobel Prize, 1963.

Fleming, Sir Alexander (1881–1955). Discovered penicillin (1928); initiated antibiotics. Nobel Prize, 1945. The science was developed in the U.S. by Selman A. Waksman.

Moseley, Henry G. J. (1887–1915). Discovered the relation between frequency of x-rays emitted by an element and its atomic number, thus indicating its true position in the Periodic Table.

Adams, Roger (1889–1971). Noted educator and contributor to industrial research in catalysis and structural analysis. Priestley Medal.

Midgley, Thomas (1889–1944). Discovered tetraethyllead and antiknock treatment for gasoline (1921) and fluorocarbon refrigerants; early research on synthetic rubber.

Banting, Sir Frederick (1891–1941). Isolated the insulin molecule. Nobel Prize, 1923.

Chadwick, Sir James (1891–1974). Discovered the neutron (1932). Nobel Prize, 1935.

Urey, Harold C. (1894–1981). Discovered heavy isotope of hydrogen (deuterium). Nobel Prize, 1934. A leader of the Manhattan Project. Made original contributions to theories of the origin of the universe and of life processes.

Carothers, Wallace (1896–1937). Polymerization research resulting in synthesis of neoprene (polychloroprene) and of nylon (polyamide).

Heisenberg, W. K. (1901–1976). Research in quantum mechanics resulting in development of the orbital theory of chemical bonding. Stated Uncertainty Principle. Nobel Prize, 1932.

Fermi, Enrico (1901–1954). First to achieve a controlled nuclear fission reaction (1939); basic research on subatomic particles. Nobel Prize, 1938.

Lawrence, Ernest O. (1901–1958). Invented the cyclotron, in which first synthetic elements were created. Nobel Prize, 1939.

Libby, Willard F. (1908–1980). Developed radiocarbon dating technique based on carbon-14. Nobel Prize, 1960.

Ho Symbol for the element holmium, named after Stockholm, Sweden.

Hofmann, August Wilhelm (1818–1892). German organic chemist who studied under Liebig. While professor of chemistry at the Royal College of Chemistry in London, he did original research on coal-tar derivatives which later led him into a study of organic dyes. Perkin, who first synthesized the dye mauveine in England, was a student of Hofmann. When the latter returned to Germany, he continued his work in the field of dyes, which became the basis of German leadership in synthetic dye manufacture which continued until World War I.

hole. A term used in semiconductor technology to refer to an energy deficit in a crystal lattice due to (1) electrons ejected from unsatisfied covalent bonds at sites where an atom is missing (vacancy) or (2) to electrons supplied by atoms of impurities present in the crystal, e.g., arsenic or boron. The free electrons from these two sources move through the crystal leaving energy deficits which are positively charged; these deficit sites, or holes, are also considered to move as they become alternately filled and vacated by electrons; thus, a flow of positive electricity results. *See also* semiconductor; impurity; vacancy.

holmium. An element.

Symbol	Ho	Atomic No.	67
State	Solid	Atomic Wt.	164.9304
Group	IIIB	Valence	3

Holmium, m.p. 1470°C (2678°F), is a rare earth metal prepared by reducing holmium fluoride with calcium. It is strongly electropositive; it has a high magnetic moment and electrical resistivity. It also has scavenging properties. There are no important industrial uses of holmium, though it is of considerable theoretical interest. It has only one stable form. *See also* lanthanide series.

holocellulose. The carbohydrate component of wood; depending on the species and botanical nature of the wood, its holocellulose content varies between 67 and 80%, the remainder being lignin. Holocellulose is not soluble in water; it is composed of alpha-cellulose (insoluble in strong caustic) and hemicellulose (soluble in weak caustic). Alpha-cellulose is the basis of paper manufacture. *See also* cellulose; paper.

homo-. A prefix having the meaning of "the same," as in the terms *homogeneous* ("the same kind"), *homologous* ("the same proportion"), *homopolymer*, etc.

homocyclic. Any organic molecule which has a ring or cyclic structure in which the ring contains only one element, which is usually carbon. This is true of cycloparaffins, cycloolefins, benzene and its derivatives, and cyclic terpenes. The term carbocyclic is also used for rings composed only of carbon. *See also* heterocyclic.

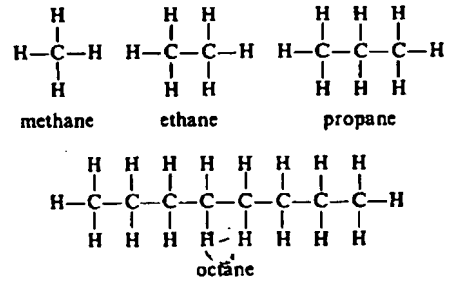
homogeneous. (1) Derived from *homo* ("the same") and *gen* ("kind"), this term is properly applied to chemical elements and compounds but not to mixtures or solutions. For example, pure water is homogeneous, whereas gasoline is not; nitrogen is homogeneous, but air is not. (Those which are not homogeneous are heterogeneous.) A compound can be subdivided or decomposed only by a chemical or electrochemical reaction, the products of which are different from the starting substance, whereas mixtures can be separated into their components by physical means such as evaporation, distillation, filtration, etc.

(2) The term is loosely (but improperly) used to describe mixtures of two or more liquids (solutions) which are uniformly dispersed in each other, so that samples taken at random have the same percentage composition. Under these conditions, a solution of water and alcohol, for example, is said to be homogeneous, regardless of the fact that it is comprised of two compounds that can easily be separated by heating. The term is similarly applied to colloidal dispersions.

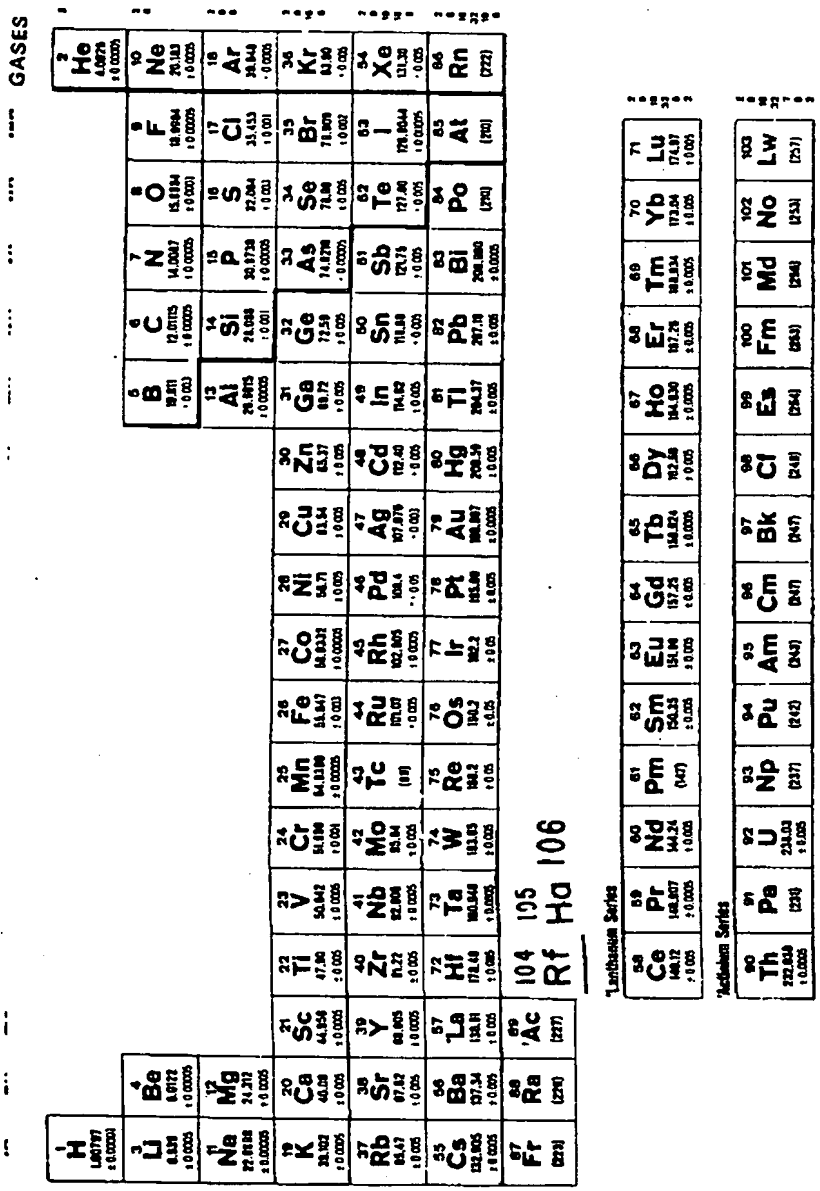
(3) A homogeneous reaction is one involving only a single phase of matter, as in certain types of catalysis in which the catalyst and the reacting substances are both liquids. *See also* heterogeneous; homogenization; mixture; uniform dispersion.

homogenization. Reduction of the sizes of solid or semisolid particles in aqueous suspension to colloidal dimensions by mechanical action, the purpose being to stabilize the suspension so that the particles will neither rise to the surface nor precipitate. This is performed, for example, on pigments used in latex dispersions. A protective film of a hydrophilic nature (gelatin, casein) is first formed on the particles by wetting them in a water solution of these materials. The coated particles are then passed through a homogenizer, or "colloid mill," which exerts a strong shearing force that reduces the particles to uniform diameter. So-called homogenized milk is made in this way, except that its fat particles have their own protein coating. The operation may also be applied to paints and similar solid-liquid dispersions. The products are not homogeneous in the strict sense of the word. *See also* homogeneous; heterogeneous.

homologous series. A related succession of organic compounds, each containing one more carbon atom and two more hydrogen atoms than the one before it in the series. For example, the paraffin (alkane) hydrocarbons form a homologous series:



Thus, for the paraffin series, the generic formula is C_nH_{2n+2}. Similarly, the olefin (alkene) series has the generic formula C_nH_{2n}, and the aliphatic alcohols, $C_nH_{2n+2}OH$.



Periodic Table of the Elements

GLOSSARY OF CHEMICAL TERMS

SECOND EDITION

Clifford A. Hampel
Consulting Chemical Engineer

AND

Gessner G. Hawley
Editor, CONDENSED CHEMICAL DICTIONARY

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PREFACE TO FIRST EDITION

Dr. Samuel Johnson, who compiled the first *Dictionary of the English Language*, once remarked that people need less to be informed than to be reminded. This generalization must have been a source of comfort and hope to all who have undertaken to present definitions in any area of human knowledge. It applies with particular force to the authors of this *Glossary*, whose purpose may best be explained by two additional definitions.

The first is that of the word *definition* itself. Primarily, it involves the setting of limits or boundaries to the meaning of terms and expressions. In chemistry, as in other fields, this is far more easily said than done, for there is no predetermined way in which such limits can be established. What may be quite satisfactory to one person may be only the beginning of an extended area of further knowledge to another. The inherently tricky nature of words is also a factor: many words have two or more quite different meanings even within the framework of a single major subject, and distinctions must be drawn carefully without obscuring their underlying relationship.

A useful definition should certainly tell *what* a substance or process or phenomenon is, with an appropriate example or two; but to explain *why* it is often leads one into ever more profound depths, the ultimate reason seeming to retreat in an endless succession of *why's*. Thus, it is necessary to set limits not only to the terms themselves but also to the informational background of those for whom the definitions are intended. Since definitions that a beginning chemistry student would find illuminating would be of little value to a professional chemist, it is essential that the definer have in mind the level of knowledge and experience of his expected audience.

The second definition concerns the word *glossary*. It is a group of definitions of *selected* terms in a field of knowledge, as opposed to *dictionary*—a much more pretentious and scholarly compendium, presenting intensive coverage of the terminology of a subject area.

This Glossary is intended for those who have had minor exposure to chemistry or who require a source of review information. Superficial though it may be by some criteria, it is the only volume of chemical definitions that serves this need. The several chemical dictionaries now existing are impressive and highly useful volumes which have established well-deserved reputations; they differ among themselves in respect to emphasis and treatment and are designed primarily for professional chemists, engineers, and industrial technologists. They are of little practical use to the introductory student or to those without considerable background in chemistry.

The emphasis in this Glossary has been placed on the following:

(a) All major chemical classifications, e.g., aldehyde, alcohol, amine, sugar, protein, carbohydrate, gum, resin, wax, etc.
(b) All important functional terms, e.g., catalyst, plasticizer, solvent, surface-active agent, antioxidant, etc.
(c) Basic phenomena and processes, e.g., oxidation, photosynthesis, polymerization, optical rotation, distillation, filtration, vapor pressure, surface tension, etc.
(d) All the chemical elements, both natural and man-made.
(e) The most important compounds, e.g., ammonia, ethyl alcohol, acetone, carbon dioxide, acetic acid, etc. (the number of these has been purposely restricted).
(f) General terms, e.g., acid, base, indicator, pH, bond, intermediate, etc.
(g) Biographies of outstanding past contributors to the science of chemistry.